

No. 3851B

LA9210M

Analog Signal Processor for CD Players

OVERVIEW

The LA9210M is a bipolar analog signal processor and servocontroller IC for CD players. It is designed to be used with an LA7860/65 series digital signal processor and a minimum of external components to form a complete controller for a compact disc player.

The LA9210M operates from either a single 5 V supply, single-ended 5 V and 7 V supplies or a dual ± 5 V supply and is available in 80-pin QIPs.

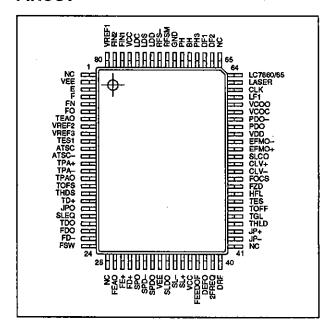
FUNCTIONS

- RF amplifier
- Slice level control
- Voltage-controlled oscillator (VCO)
- VCO control amplifier
- Automatic laser power control (APC)
- · Focus error amplifier
- Tracking error amplifier
- · Track jump amplifier
- · Focus servo preamplifier
- Tracking servo preamplifier
- Spindle servo preamplifier
- Sled servo preamplifier
- RF detector
- HF level detector
- · Defect detector
- Shock detector
- Focus switch
- · Tracking servo gain switch
- · Tracking error slice comparator

FEATURES

- Minimum of external components required
- Normal and double-speed VCO
- 5 V supply, single-ended 5 V and 7 V supplies or dual ±5 V supply
- 80-pin QIP

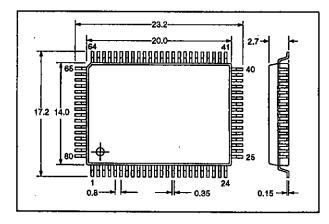
PINOUT



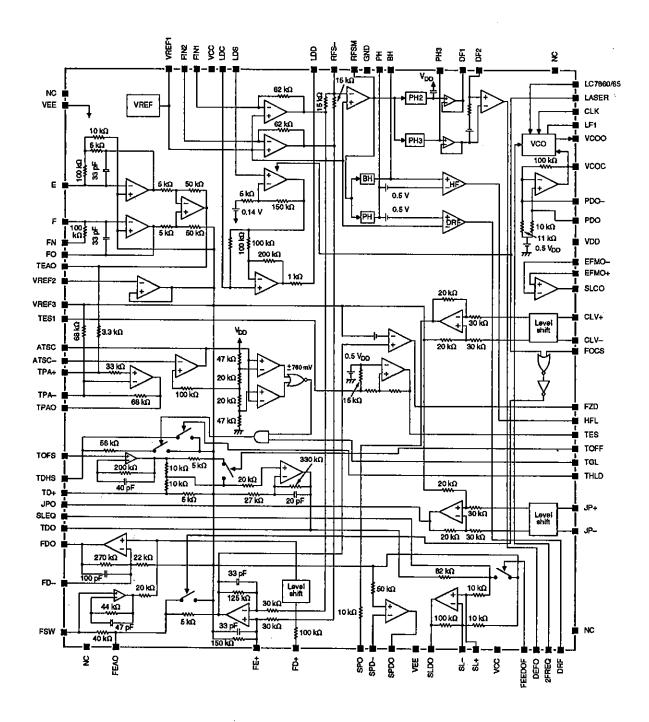
PACKAGE DIMENSIONS

Unit: mm

3174-QIP80E



SCHEMATIC DIAGRAM



SPECIFICATIONS

Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Circle and all surply unitered Con and a	Vcc	10	v
Single-ended supply voltage. See note 1.	V _{DD}	7	v
Dual supply voltage. See note 2.	V _{CC} - V _{EE}	13	v
	V _{DD}	7	· ·
TDO, FDO, SFDO and SLDO input current	l ₁	1	mA
TDO, FDO, SFDO and SLDO output current	lo	1 .	mA
Power dissipation	Po	480 (T _a ≤ 60 °C)	mW
Operating temperature range	T _{op} ę	-25 to 75	°C
Storage temperature range	T _{stg}	-40 to 150	°C

Notes

- 1. VEE connected to ground, $V_{CC} \ge V_{DD}$
- 2. VREF1, VREF2 and VREF3 connected to ground, $V_{CC} \ge V_{DD}$

Recommended Operating Conditions

 $T_x = 25 \, ^{\circ}C$

Parameter	Symbol	Rating	Unit
	V _{cc}	5	
Dual supply voltage	V _{DD}	5	v
	VEE	5	
Single-ended supply vallege ranges. See note 1	V _∞ c	4,2 to 8,0	
Single-ended supply voltage ranges. See note 1.	V _{DO}	4.2 to 6.0	"
	Vcc	4.2 lo 6.0	
Dual supply voltage ranges. See note 2.	V _{DD}	4.2 to 6.0	V
	V _{EE}	-6.0 to -4.2	

Notes

- 1. VEE connected to ground
- 2. VREF1, VREF2 and VREF3 connected to ground

Electrical Characteristics

Supply current

 $V_{CC} = 5$ V, $V_{DD} = 5$ V, $V_{EE} = -5$ V, $T_a = 25$ °C, $V_{REF1} = V_{REF2} = V_{REF3} = 0$ V unless otherwise noted

Parameter	Symbol	Condition		Rating		Unit
	Symbol	Contagion	min	typ	max	Oill
Supply current	1cc		9	18	27	
	l _{DD}		10	15	20	mA
	EE		-28	-19	-10	

RF amplifier

 $V_{CC} = 5$ V, $V_{DD} = 5$ V, $V_{EE} = -5$ V, $T_a = 25$ °C, $V_{REF1} = V_{REF2} = V_{REF3} = 0$ V unless otherwise noted

Parameter	Symbol	Condition		Rating		Unit
	Symbol	Condition	រាវារា	typ	max	Onit
RF offset voltage	V _{RF(off)}	FIN1 and FIN2 open, measured at RFSM	-0.65	-0.3	0.05	۷.
FIN1 and FIN2 RF voltage gain	GVRF	$R_g = 1 M\Omega$, $R_L = 33 k\Omega$, $f = 200 \text{ kHz}$	-12.5	-11.0	-9.5	dВ

Focus error amplifier

 $V_{CC} = 5$ V, $V_{DD} = 5$ V, $V_{EE} = -5$ V, $T_a = 25$ °C, $V_{REF1} = V_{REF2} = V_{REF3} = 0$ V unless otherwise noted

Parameter	Cumbal	Condition	Rating		Unit	
	Symbol	Condition	min	typ	max	Oill
Offset voltage	V _{FE(off)}	FIN1 and FIN2 open, measured at FEA0	-50	0	50	mV
FIN1 and FIN2 voltage gain	G _{VFE}	R_g = 1 $M\Omega$, R_L = 33 $k\Omega$, f = 1 kHz	-15.0	-11.5	-8.0	dB
FIN1 and FIN2 voltage gain differential	ΔG _{VFE}	$R_g = 1 \text{ M}\Omega, R_L = 33 \text{ k}\Omega$	-1.5	0	1.5	dB
Cutoff frequency	¹ FE(∞)	Measured at the half power point (-3 dB)	-	30	_	kHz

Focus drive amplifier

Parameter	Sumbal	Condition		Rating		Unit
	Symbol	Condition	min	typ	max	Onit
Offset voltage	V _{FD(off)}	FEAO grounded, measured at FDO	-110	0	110	mV
Voltage gain	G _{VFD}	FEAO input	21.0	22.5	24.0	dB
LOW-level search voltage	V _{FSL}	V _{FOCUS} = 5 V, V _{FD+} = 1.5 V	-3.1	-2.0	-0.9	٧
HIGH-level search voltage	V _{FSH}	V _{FOCUS} = 5 V, V _{FD+} = 3.5 V	0.9	2.0	3.1	٧

Tracking error amplifier

 V_{CC} = 5 V, V_{DD} = 5 V, V_{EE} = -5 V, T_a = 25 °C, V_{REF1} = V_{REF2} = V_{REF3} = 0 V unless otherwise noted

Parameter		O Ital	· · · · · · · · · · · · · · · · · · ·	Rating		Unit
	Symbol	Condition	min	typ	max	ÇIII.
Offset voltage	VTE(off)	5 kΩ resistor between FN and FO, 10 kΩ resistor between FN and ground, E and F open, measured at TEAO	-200	0	200	m∨
Voltage gain	G _{VTE}	5 k Ω resistor between FN and FO, 10 k Ω resistor between FN and ground, E and F open, $f = 1$ kHz	1.0	4.5	8.0	dB
Voltage gain differential	ΔG _{VTE}	5 kΩ resistor between FN and FO, 10 kΩ resistor between FN and ground	1	0	1	dB
Cutoff frequency	f _{TE(∞)}	Measured at the half- power point (-3 dB)	-	30	-	kHz

Tracking error preamplifier

 V_{CC} = 5 V, V_{DD} = 5 V, V_{EE} = -5 V, T_a = 25 °C, V_{REF1} = V_{REF2} = V_{REF3} = 0 V unless otherwise noted

	01-1	O Males		Rating		Unit
Parameter ·	Symbol	Condition	mln	typ	max	Onn.
Offset voltage	V _{TP(off)}	5 kΩ resistor between FN and FO, 10 kΩ resistor between FN and ground, measured at TPAO	–3 50	0	350	mV
Voltage gain	G _{VTP}	5 k Ω resistor between FN and FO, 10 k Ω resistor between FN and ground, TPA+ open, 1 M Ω resistor between E and F, f = 1 kHz	7.0	10.5	14.0	dB

Tracking detector amplifier

Parameter	01.1	Oon did on		Rating		Unit
	Symbol	Condition	min	typ	max	Oilli.
Offset voltage	VTD(off)	200 kΩ resistor between TOFS and ground, measured at TDO	-120	0	120	mV
Voltage gain	G _{VTD}	200 kΩ resistor between TOFS and ground, TOFS input, TD- open	16.5	18.0	19.5	dB

Peak hold circuit

 V_{CC} = 5 V, V_{DD} = 5 V, V_{EE} = -5 V, T_a = 25 °C, V_{REFi} = V_{REF2} = V_{REF3} = 0 V unless otherwise noted

Parameter	Cumbal	Condition		Rating		Unit
	Symbol	Condition	min	typ	max	Ont
Offset voltage	V _{PH(off)}	I _{FIN1} = I _{FIN2} = 7.3 µA, measured between PH and RFSM	-0.2	-0.1	0.1	V

RF detector

 $V_{CC} = 5$ V, $V_{DD} = 5$ V, $V_{EE} = -5$ V, $T_a = 25$ °C, $V_{REF1} = V_{REF2} = V_{REF3} = 0$ V unless otherwise noted

	Q	0		Rating		Unit
Parameter	Symbol	Condition	mln	typ	max	Oilli
LOW-level threshold voltage		The voltage on PH at which DRF goes LOW	_	-	0.5	
	VDRFL(TO)	The voltage between PH and VREF1 at which DRF goes LOW. REF1, REF2 and REF3 open	-	-	0.28	V
HIGH-level threshold voltage		The voltage on PH at which DRF goes HIGH	1.15	_	-	
	VDRFH(TO)	The voltage between PH and VREF1 at which DRF goes HIGH. REF1, REF2 and REF3 open	0.72	-	-	v
LOW-level output voltage	V _{DRF(OL)}		_	0	0.6	٧
HIGH-level output voltage	V _{DRF(OH)}		4.0	4.1	4.6	V

Focus zero-crossing detector

Dominion	0	Condition		Rating		Unit
Parameter	Symbol	Condition	min	typ	max	Oint
LOW-level threshold voltage	V _{FZDL} (TO)	1 MΩ FIN2 input resistor, the voltage on FEAO at which FZD goes LOW	-	-	-0.85	٧
HIGH-level threshold voltage	V _{FZDH(TO)}	1 MΩ FIN2 input resistor, the voltage on FEAO at which FZD goes HIGH	-0.35	-	-	V
LOW-level output voltage	V _{FZD(OL)}		-	0	0.6	V
HIGH-level output voltage	V _{FZD(OH)}	·	4.0	4.1	4.6	٧

Bottom hold circuit

 V_{CC} = 5 V, V_{DD} = 5 V, V_{EE} = -5 V, T_a = 25 °C, V_{REF1} = V_{REF2} = V_{REF3} = 0 V unless otherwise noted

Parameter	Symbol	Condition		Unit		
			mln	typ	max	Sill.
Offset voltage	V _{BH(off)}	f _{FIN1} = I _{FIN2} = 7.3 μA, measured between BH and RFSM	-0.2	-0.1	0.1	٧

High-frequency level comparator

 $V_{CC} = 5$ V, $V_{DD} = 5$ V, $V_{EE} = -5$ V, $T_a = 25$ °C, $V_{REF1} = V_{REF2} = V_{REF3} = 0$ V unless otherwise noted

Parameter		Con distan	Rating			Unit
	Symbol	Condition	mln	typ	max	Oili
LOW-level threshold voltage	V _Н гцто)	V _{PH} = 0 V, the voltage on BH at which HFL goes LOW	-	-	-0.7	V
HIGH-level threshold voltage	V _{нғн(то)}	V _{PH} = 0 V, the voltage on BH at which HFL goes HIGH	-0.3	-	-	ν
LOW-level output voltage	V _{HF(OL)}		_	0	0.6	٧
HIGH-level output voltage	V _{HF(OH)}		4.0	4.1	4.6	٧

Tracking error slice comparator

 V_{CC} = 5 V, V_{DD} = 5 V, V_{EE} = -5 V, T_a = 25 °C, V_{REF1} = V_{REF2} = V_{REF3} = 0 V unless otherwise noted

Parameter	Symbol	Condition	Rating			- Unit
		Condition	mln	typ	max	
LOW-level threshold voltage	VTESL(TO)	100 kΩ TES1 input resistor, the voltage on TES1 at which TES goes LOW	1.0	1.7	2.5	V
HIGH-level threshold voltage	V _{ТЕ} ВН(ТО)	100 kΩ TES1 input resistor, the voltage on TES1 at which TES goes HIGH	2.5	3.5	4.0	v
LOW-level output voltage	V _{TES(OL)}		0	0.2	1.0	٧
HIGH-level output voltage	VTES(OH)		4,0	4.1	4.6	V

Jump pulse amplifier

		Condition		Unit		
Parameter	ameter Symbol		mln	typ	max	
Offset voltage	V _{JP(off)}	Measured at JPO	-20	0	20	mV
LOW-level output voltage	V _{JP(OL)}	JP- = 5 V	-3.55	-3.20	-2.85	V
HIGH-level output voltage	V _{JP(ОН)}	JP+ = 5 V	2.85	3.20	3.55	٧

Servo pulse amplifier

 $V_{CC} = 5$ V, $V_{DD} = 5$ V, $V_{EE} = -5$ V, $T_a = 25$ °C, $V_{REF1} = V_{REF2} = V_{REF3} = 0$ V unless otherwise noted

Parameter Symbol	Count of	Condition		Unit		
	Symbol		min	typ	max) Oill
Offset voltage	V _{SP(off)}	Measured at SPO	-20	0	20	mV
LOW-level output voltage	V _{SP(OL)}	V _{CLV} - = 5 V	-3.55	-3.20	-2.85	٧
HIGH-level oulput voltage	V _{SP(OH)}	V _{CLV+} = 5 V	2.85	3.20	3.55	V

Spindle drive amplifier

 $V_{CC} = 5$ V, $V_{DD} = 5$ V, $V_{EE} = -5$ V, $T_a = 25$ °C, $V_{REF1} = V_{REF2} = V_{REF3} = 0$ V unless otherwise noted

Parameter	r Symbol	Condition	Rating			Unit
Parameter			mln	typ	max	Oint
Offset vollage	V _{SPD(off)}	51 kΩ resistor between SPD— and SPDO, measured at SPDO	-110	0	110	mV
Voltage gain	Gyspd	51 k Ω resistor between SPD— and SPDO, 51 k Ω SPD— input resistor	-1.5	0	1.5	dB

Sled amplifier

 $V_{CC} = 5$ V, $V_{DD} = 5$ V, $V_{EE} = -5$ V, $T_a = 25$ °C, $V_{REF1} = V_{REF2} = V_{REF3} = 0$ V unless otherwise noted

Parameter Sy	Cumbal	mbol Condition -		Unit		
	Symbol		min	typ	max	Ont
Offset voltage	V _{SLD(off)}	SLEQ grounded, measured at SLDO	-60	0	60	mV
Output voltage with gain	V _{SLD(G)}	SLEQ grounded, IsL+ = 10 µA	1.2	1.9	2.6	٧

VCO control amplifier

Douanalan	Parameter Symbol	Condition	<u> </u>	Unit		
raiainotei			min	typ	max	- Oint
Quiescent output voltage	Vvcoc(o)	Measured at VCOC	2.3	2.5	2.7	V
Output voltage with gain	V _{VCoC(G)}	I _{PDO} = 10 μA	3.15	3.50	3.85	٧

Slice level comparator amplifier

 $V_{CC} = 5$ V, $V_{DD} = 5$ V, $V_{EE} = -5$ V, $T_a = 25$ °C, $V_{REF1} = V_{REF2} = V_{REF3} = 0$ V unless otherwise noted

Parameter	Symbol	Condition		Unit		
			min	typ	max	Oint
Output voltage	VsLQ(0)	10 $k\Omega$ resistor between SLCO and EFMO-, 10 $k\Omega$ resistor between EFMO+ and 2.5 V reference	2.4	2.5	2,6	γ,

Focus switch

 $V_{CC} = 5$ V, $V_{DD} = 5$ V, $V_{EE} = -5$ V, $T_a = 25$ °C, $V_{REF1} = V_{REF2} = V_{REF3} = 0$ V unless otherwise noted

Parameter	Symbol Condition	0141	Rating			Unit
		Condition	min	typ	max	Oilit
Offset voltage	V _{FSW(off)}	V _{FOCS} = 5 V, measured at FEAO	20	0	20	mV
Focus switch OFF threshold voltage	V _{FSW1(TO)}	The voltage on FOCS at which the focus switch turns OFF	-	-	1.0	٧
Focus switch ON threshold voltage	V _{FSW2(TO)}	The voltage on FOCS at which the focus switch turns ON	4.0	-	-	٧

Tracking OFF switch

 $V_{CC} = 5$ V, $V_{DD} = 5$ V, $V_{EE} = -5$ V, $T_a = 25$ °C, $V_{REP1} = V_{REP2} = V_{REP3} = 0$ V unless otherwise noted

Parameter	Symbo!	Condition	Rating			Unlt
			min	typ	max	UINL
Offset voltage	V _{TFS(off)}	V _{TOFF} = 5 V, 200 kΩ TOFS input resistance, V _{TOFS} = 0.126 V	-20	80	160	mV
Tracking OFF switch OFF threshold voltage	V _{TFS1(TO)}	The voltage on TOFF at which the tracking OFF switch turns OFF	-	-	1.0	٧
Tracking OFF switch ON threshold voltage	V _{TFS2(TO)}	The voltage on TOFF at which the tracking OFF switch turns ON	4.0	-	-	٧

Tracking hold switch

Parameter	Symbol	Condition		Unit		
			min	typ	max	Oint
Offset voltage	V _{THS(off)}	56 kΩ resistor between THDS and 5 V reference, V_{THLD} = 5 V, measured at THDS	60	0	60	mV
Tracking hold switch OFF threshold voltage	Vтнs:(то)	The voltage on THLD at which the tracking hold switch lums OFF	_	-	1.0	٧
Tracking hold switch ON threshold voltage	V _{THS2(TO)}	The voltage on THLD at which the tracking hold switch turns ON	4.0	-	-	٧

Tracking servo gain switch

 $V_{CC} = 5$ V, $V_{DD} = 5$ V, $V_{EE} = -5$ V, $T_a = 25$ °C, $V_{REF1} = V_{REF2} = V_{REF3} = 0$ V unless otherwise noted

Parameter	Comples!	Condition	Rating			Unit
	Symbol	Condition	min	typ	max	Out
Tracking gain LOW-level switch OFF threshold voltage	Vresi(TO)	The voltage on TGL at which the tracking gain LOW-level switch turns OFF		-	1.0	٧
Tracking gain LOW-level switch ON threshold voltage	Vтаs2(то)	The voltage on TGL at which the tracking gain LOW-level switch turns ON	4.0	-	-	V

Sled amplifier OFF switch

 $V_{CC} = 5$ V, $V_{DD} = 5$ V, $V_{EE} = -5$ V, $T_a = 25$ °C, $V_{REP1} = V_{REP2} = V_{REP3} = 0$ V unless otherwise noted

Parameter	Cumbal	Condition		Rating	ng	linit
	Symbol	Continion	min	typ	max	. Unit
Sled OFF switch OFF threshold voltage	VsFs1(TO)	The voltage on FEEDOF at which the sled OFF switch turns OFF	-	- ;	0.5	V
Sled OFF switch ON threshold voltage	Vsfs2(TO)	The voltage on FEEDOF at which the sled OFF switch turns ON	2.0	_	-	٧

Automatic laser power control circuit

Parameter	Sumbal.	Condition		Rating		Unit
Parameter	Symbol	Condition	ním	typ	max	Onit
Start voltage P	VAPCP(S)	LDC open, V _{LDD} = -3 V, measured on LDS	-4.95	-4.91	-4.87	٧
End voltage P	V _{APCP(E)}	LDC open, V _{LDD} = 3 V, measured on LDS	-4.85	-4 .81	4.77	٧
Start voltage N	Vapcn(s)	LDC grounded, VLDD = 3 V, measured on LDS	-4,93	-4.89	-4.85	٧
End voltage N	Vapcn(e)	LDC grounded, V _{LDD} = -3 V, measured on LDS	4.87	-4.83	-4.79	V
OFF voltage P	VAPCP(OFF)	LDC open, V _{LASER} = 5 V	4.0	4.6	5.0	V
OFF voltage N	Vapon(off)	LDC grounded, VLASER = 5 V	-5.0	-4.3	-4.0	٧
Automatic power control OFF threshold voltage	Vapci	The voltage on LASER at which the focus switch turns OFF and the automatic power control circuit turns ON	-	-	1,0	V
Automatic power control ON threshold voltage	VAPC2	The voltage on LASER at which the focus switch turns ON and the automatic power control circuit turns OFF	4,5	·. <u>-</u>	_	٧

Defect detector circuit

 $V_{CC} = 5$ V, $V_{DD} = 5$ V, $V_{EE} = -5$ V, $T_a = 25$ °C, $V_{REF1} = V_{REF2} = V_{REF3} = 0$ V unless otherwise noted

Parameter	Symbol	Condition		Rating		Unit
	Symbol	Condition	min	typ	max	Olik
Offset voltage	V _{DF(off)}	$I_{FIN1} = I_{FIN2} = 7.3 \mu A$, 10 kΩ resistor between FEFO and ground	0.2	0.4	0.6	v
LOW-level output voltage	V _{DF(OL)}		-	ó	0.2	٧
HIGH-level output voltage	V _{DF(OH)}		4.0	4.8	5.0	V

Shock detector circuit

 $V_{CC} = 5$ V, $V_{DD} = 5$ V, $V_{EE} = -5$ V, $T_a = 25$ °C, $V_{REF1} = V_{REF2} = V_{REF3} = 0$ V unless otherwise noted

Parameter	Oumshall	Rating		Rating		Rating	Unit
	Symbol	Condition	min	typ	max	V	
Quiescent voltage	V _{SH(OFF)}	Measured on ATSC	2.3	2.5	2.7	٧	
Detector LOW-level threshold voltage	V _{SHCL(TO)}	ATSC- current (between 0 and -15 μA) at which V _{THDS} = 4 V	-9.0	- 7.5	6.0	μΑ	
Detector HIGH-level threshold voltage	V _{SHCH(TO)}	ATSC- current (between 0 and -15 µA) at which VTHDS = 4 V	6.0	7.5	9.0	μА	

Voltage-controlled oscillator

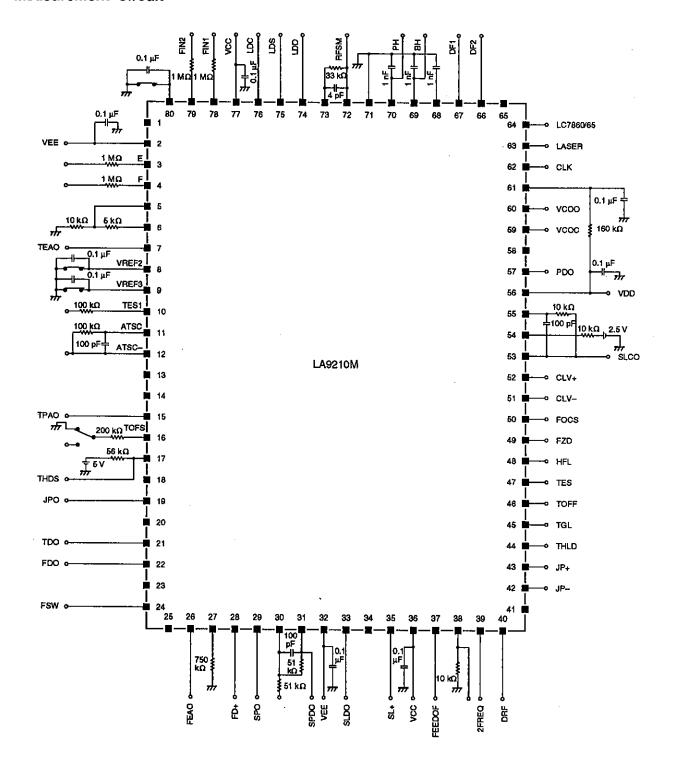
Parameter	Symbol	Condition	-	Rating		Unit MHz
	Symbol	Conducti	mln	typ	max	Onk
Free-running frequency	f	LC7860/65 grounded, f _{CLK} = 4.3224 MHz, V _{2FREQ} = 0 V, 160 k Ω resistor between LF1 and 5 V	8.14	8.64	9.14	1.6U-2
	fvco	$V_{LC788068}$ = 5 V, f_{CLK} = 2.1609 MHz, V_{2FREQ} = 0 V, 160 kΩ resistor between LF1 and 5 V	8.14	8.64	9,14	WIGZ
Maximum adjustment frequency	Δίγο	$V_{PDO}=2$ V, $V_{LC7860/85}=5$ V, $f_{CLK}=2.1609$ MHz, $V_{2FREQ}=0$ V, 160 kΩ resistor between LF1 and 5 V	0.60	0.95	-	MHz
Minimum adjustment frequency	Δίνοο2	V _{PDO} = 3 V, V _{LC786065} = 5 V, t _{CLK} = 2.1609 MHz, V _{2FREQ} = 0 V, 160 kΩ resistor between LF1 and 5 V	_	-0.95	-0.60	MHz

Parameter	Complete	Condition	Rating	Unit		
	Symbol	Condition	mln	typ	max	Oilit
Output voltage Vycoz(o)	Vyco1(o)	$V_{LC786065} = 5$ V, $I_{CLK} = 2.1609$ MHZ, $V_{2FREQ} = 5$ V, 160 kΩ resistor between LF1 and 5 V	0.5	2.0	4.0	V _{PP}
	Vvc02(O)	$V_{LC786065}$ = 5 V, I_{CLK} = 2.1609 MHz, V_{2FREQ} = 0 V, 160 kΩ resistor between LF1 and 5 V	0.5	2.0	4.0	V _{P-P}

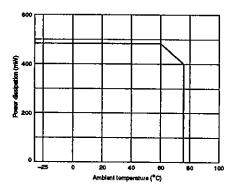
Reference voltage

Parameter	Symbol	Condition	Rating			Unit
	Зупшог	Condition	min	typ	max	Oill
VREF1 reference voltage	V _{REF1}	Measured at VREF1 with VREF1 open	-3,55	-3.30	-3.05	٧
VREF3 reference voltage	V _{REF3}	Measured at VREF3 with VREF2 and VREF3 open	-0.15	0	0.15	٧

Measurement Circuit



Typical Performance Characteristics Power dissipation vs. ambient temperature



- No products described or contained herein are intended for use in surgical implants, life-support systems, aerospace equipment, nuclear power control systems, vehicles, disaster/crime-prevention equipment and the like, the failure of which may directly or indirectly cause injury, death or property loss.
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